Fundamental Mechanics: Quiz 8

25 October 2016

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Formulae: $K = \frac{1}{2}mv^2$ $W = \vec{\mathbf{F}} \cdot \Delta\vec{\mathbf{r}} = F\Delta r \cos\theta$ $W_{\text{net}} = \Delta K$ $g = 9.80\,\text{m/s}^2$

$F_{\text{spring}} = -k\Delta s$ $W_{\text{spring}} = -\frac{1}{2}k(\Delta s_f)^2 + \frac{1}{2}k(\Delta s_i)^2$ $P = \frac{W}{\Delta t}$

A 40 kg crate is lifted vertically by a rope and moves up at a constant speed. The motor which pulls the rope provides power of 800 W. Determine the **work done by the rope** in 5.0 s and use the result to determine **how high the crate is lifted** in that time.

$\Sigma F_y = 0$

$\vec{T} - mg = 0$

$\vec{T} = mg$

$\vec{T} = 40\,\text{kg} \cdot 9.8\,\text{m/s}^2$

$\vec{T} = 392\,\text{N}$

$\text{Power} = \frac{\text{work}}{\text{Time}}$

$800\,\text{W} = \frac{W}{5.0\,\text{s}}$

$W = 4000\,\text{J/s}$

$W = \vec{F} \cdot \Delta r$ $\vec{F} = 392\,\text{N}$ $W = 4000\,\text{W}$

$4000\,\text{J/s} = 392\,\text{N} \cdot \Delta r$

$\frac{4000\,\text{J/s}}{392\,\text{N}} = \Delta r$

$\Delta r = 10.2\,\text{m}$